Evaluation of Carbon Composite Vessels Fabrication using Ionic Liquid Epoxies for Cryogenic Liquid Containment

Completed Technology Project (2015 - 2016)

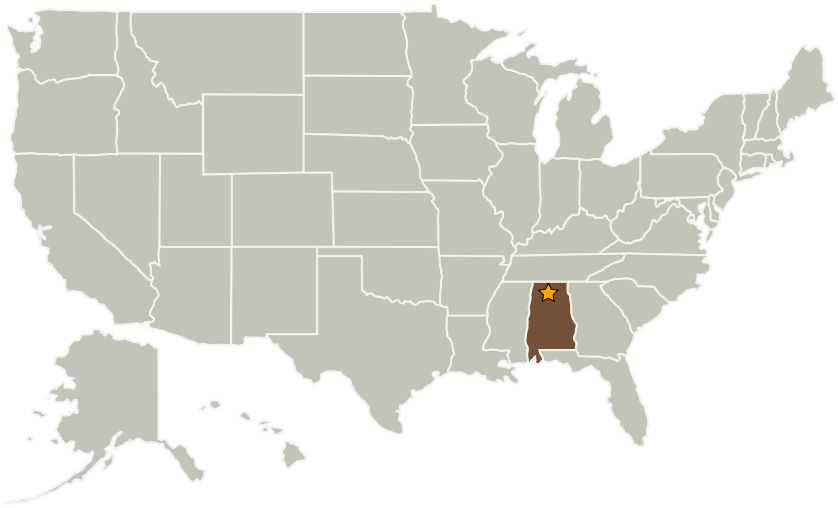
Project Introduction

The intent of the work proposed here is to ascertain the viability of ionic liquid (IL) epoxy based carbon fiber composites for use as storage tanks at cryogenic temperatures. This IL epoxy has been specifically developed to address composite cryogenic tank challenges associated with achieving NASA's in-space propulsion and exploration goals. Our initial work showed that an unadulterated ionic liquid (IL) carbon-fiber composite exhibited improved properties over an optimized commercial product at cryogenic temperatures. Subsequent investigative work has significantly improved the IL epoxy and our first carbon-fiber Composite Overwrap Pressure Vessel (COPV) was successfully fabricated. Here additional COPVs, using a further improved IL epoxy, will be fabricated and pressure tested at cryogenic temperatures with the results rigorously analyzed. Investigation of the IL composite for lower pressure liner-less cryogenic tank applications will also be initiated. It is expected that the current Technology Readiness Level (TRL) will be raised from about TRL 3 to TRL 5 where unambiguous predictions for subsequent development/testing can be made.

Anticipated Benefits

Continue cutting edge development of ionic liquid (IL) epoxy-based composites for cryogenic fuel tanks, to eliminate problems with cracking/delamination and enable space application of composite cryotanks.

Primary U.S. Work Locations and Key Partners



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Center Innovation Fund: MSFC CIF

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
AZ Technology, Inc.	Supporting Organization	Industry Veteran-Owned Small Business (VOSB), Women-Owned Small Business (WOSB)	Huntsville, Alabama
Kaneka North America	Supporting Organization	Industry	

Primary U.S. Work Locations
Alabama

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

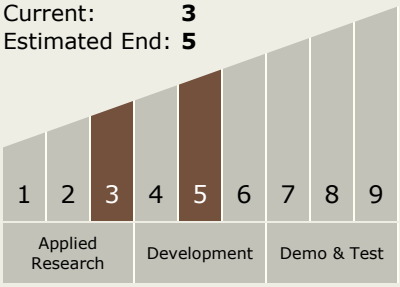
John W Dankanich

Principal Investigator:

Richard N Grugel

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic